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NO DRAWINGS

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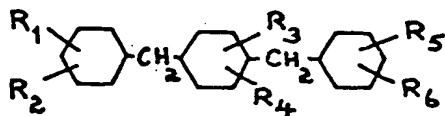
COMPLETE SPECIFICATION

Improvements in Softening Agents for Polymers of Vinyl Chloride

We, CHEMISCHE WERKE HÜLS AKTIEN-GESELLSCHAFT, a German Company, of (21a) Marl, Kreis Recklinghausen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described and by the following statement:—

It is already known that hydrocarbon fractions, such as high boiling mineral oil fractions and mineral coal tar fractions, cannot in general use be used as softening agents for polymers of vinyl chloride because they do not gelatinise sufficiently with these polymers. As so-called extenders or softener diluents they can only partly replace the usual softening agents, especially the ester softeners. The addition of extenders reduces the viscosity of the pastes made from the polymers of vinyl chloride and the softening agents and thereby facilitates their handling and working up. By reason of the facts that these extenders have throughout a dark intrinsic colour and a tendency to exude, they worsen the properties of the gelatinised products however.

We have found that dibenzylbenzenes of the formula:



in which R_1 , R_2 , R_3 , R_4 , R_5 and R_6 each represents hydrogen or a separate monovalent alkyl, cycloalkyl or aralkyl radical can be used with advantage as softening agents for polymers of vinyl chloride. Among polymers of vinyl chloride we include not only polyvinyl chloride but also copolymers of preponderant amounts of vinyl chloride with other polymerisable compounds, such as vinyl acetate, vinylidene chloride and acrylonitrile. The dibenzylbenzenes may be substituted by alkyl

radicals with 1 to 4 carbon atoms, by cycloalkyl radicals, such as cyclohexyl, or by aralkyl radicals. The total number of carbon atoms in the radicals R_1 to R_6 should advantageously not exceed 25 and better still should not exceed 20. Suitable compounds, besides dibenzylbenzene itself, are especially dibenzyltoluene, tribenzyltoluene, dixylylxylene and their alkyl, cycloalkyl or aralkyl derivatives or mixtures of the said compounds which are readily accessible industrially and can be obtained for example according to the process of application No. 10988/57 (Serial No. 824,878).

The dibenzylbenzenes are used in amounts of 5 to 40% by weight with reference to the polymer of vinyl chloride. With a content of 5 to 20%, products similar to agglomerates are obtained which can be conveyed and worked up directly in screw presses. With a content of 20 to 40%, kneadable compositions are formed which are convenient to handle and which can be worked up either cold or in the heated state. After gelatinisation, these mixtures of vinyl chloride polymers and dibenzylbenzenes yield products which correspond in the Shore hardness to hard polyvinyl chloride but have a considerably better notched bar impact strength and do not exhibit the troublesome discolourations such as are caused by hydrocarbon fractions used as extenders.

The dibenzylbenzenes may be used with special advantage in admixture with the usual softening agents, especially the so-called ester softeners. Their miscibility and compatibility is almost unlimited. In general, ester-softener: dibenzylbenzene in the weight ratio 95:5 to 50:50 are used in admixture. In admixture with these usual softening agents, the dibenzylbenzenes act at temperatures up to 160° C. like the known extenders, in that they reduce the viscosity of the pastes made from the polymers and the softening agents. In contrast to the extenders, however, they

take part in the gelatinisation at temperatures above 160° C. so that they are firmly anchored in the gelatinised products and do not exude. Moreover they impart a superior Shore hardness and tensile strength to the polymers.

The following Examples will further illustrate this invention but the invention is not restricted to these Examples. The parts are parts by weight.

EXAMPLE 1.

70 parts of polyvinyl chloride are intimately mixed with 30 parts of dibenzyltoluene. A kneadable composition forms. A test rod (4 × 6 × 50 mm.) prepared therefrom under a press at 170° C. has a notched bar

impact strength according to DIN 53453 of about 50 cm.kg.cm⁻² (with hard polyvinyl chloride this figure is 3 to 5). The Shore hardness amounts to 97° (with hard polyvinyl chloride this figure is 95° to 100°).

EXAMPLE 2.

In a rolled foil of 60 parts of polyvinyl chloride and 40 parts of dioctyl phthalate, the dioctyl phthalate is replaced in stages by dixylylene until half has been thus replaced. On samples of the various foils there are then determined under identical conditions the tensile strength, extension, cold impact strength and Shore hardness. The results are collected in the following Table 1:

TABLE 1

Polyvinyl chloride	60	60	60	60	60
dioctyl phthalate	40	35	30	25	20
dixylylxylene	—	5	10	15	20
tensile strength kg/cm ²	168	175	183	197	204
extension in %	371	367	360	354	342
cold impact strength °C.	-25	-25	-25	-25	-25
Shore hardness °	70	72	73	77	80

The tensile strength and Shore hardness of the samples increases with increasing content of dixylylxylene.

EXAMPLE 3.

In a paste of 60 parts of polyvinyl chloride and 40 parts of dioctyl phthalate,

the dioctyl phthalate is replaced in stages up half by a mixture of 80% of dibenzyltoluene and 20% of benzylidibenzyltoluene. Then the viscosity of the pastes is determined. The results are collected in the following Table 2:

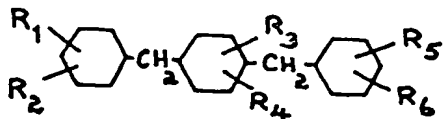
TABLE 2

polyvinyl chloride	dioctyl phthalate	mixture of dibenzyltoluene and benzyl -di-benzyltoluene	viscosity in poises at 25° C.
60	40	0	40
60	35	5	29
60	30	10	26
60	25	15	24
60	20	20	20

The viscosity becomes smaller as the content of dibenzyl-benzenes is increased.

WHAT WE CLAIM IS:—

- 5 1. A process for softening a polymer of vinyl chloride wherein a dibenzylbenzene of the formula:



- 10 in which R_1 , R_2 , R_3 , R_4 , R_5 , and R_6 each represents hydrogen or a separate mono-valent alkyl, cycloalkyl or aralkyl radical is used as a softening agent in an amount of from 5 to 40% by weight with reference to the polymer.

2. A process as claimed in claim 1 carried out substantially as described in any of the foregoing Examples. 15

3. Any polymer of vinyl chloride which contains a dibenzylbenzene as specified in claim 1.

4. A polymer as claimed in claim 3 20 wherein the radicals R_1 to R_6 in the dibenzylbenzene contain a total number of carbon atoms which does not exceed 25 and preferably does not exceed 20.

5. A polymer as claimed in claim 3 or 4 25 wherein the dibenzylbenzene is used in admixture with another softening agent.

6. A polymer as claimed in claim 5 30 wherein the weight ratio of dibenzylbenzene to the other softening agent is between 95:5 and 50:50.

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